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BREEDING DENSITY, NEST SITES, CLUTCH SIZE AND EGG DIMENSIONS OF THE MAGPIE (*PICA PICA*) IN NW CROATIA

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Dolenec, Z.: Breeding density, nest sites, clutch size and egg dimensions of the magpie (*Pica pica*) in NW Croatia. Nat. Croat., Vol. 9, No. 2., 107–114, 2000, Zagreb.

Between 1997 and 1998 the breeding density, nest sites, clutch size and egg dimensions of the magpie *(Pica pica*) was investigated in a 7 km^2 area in the Krapina river valley. We recorded a high breeding density of 4.79 pairs/km^2 (during both years). The nests were situated at a height of 1–16 m above ground (mean = 6.74 m). Magpie nests were found in at least 9 species of bushes and trees. We recorded 3–8 eggs in the first clutch (mean = 5.91 eggs). Egg length averaged 33.43 mm, egg breadth 23.35 mm, egg volume 9.288 cm^3, egg shape index 1.433 and egg weight 9.22 g. There were no significant differences in egg dimensions between 1997 and 1998 (length: $F = 1.79$, $p = 0.10$; breadth: $F = 1.41$, $p = 0.34$; volume: $F = 1.27$, $p = 0.52$; shape index: $F = 1.10$, $p = 0.78$). The positive correlation between egg volume and egg breadth, egg volume and egg length, egg length and egg shape index as well as between egg length and egg breadth were statistically significant. So was the negative correlation between egg breadth and egg shape index. The correlation coefficient (r) between egg volume and egg shape index was near 0.

Key words: magpie, *Pica pica,* breeding habits, position of nest, clutch size, egg dimensions, NW Croatia

Dolenec, Z.: Gustoća tijekom gniježđenja, smještaj gnijezda, veličina pologa i dimenzije jaja vrste svraka (*Pica pica*) na području sjeverozapadne Hrvatske. Nat. Croat., Vol. 9, No. 2., 107–114, 2000, Zagreb.

U razdoblju od 1997. do 1998. godine istraživana je gustoća parova na gniježdenju, smještaj gnijezda, veličina pologa i dimenzije jaja svrake *(Pica pica)* u nizini rijeke Krapine na površini 7 km^2. Zabilježena je visoka gustoća naseljenosti 4.79 para /km^2 (prosjek za obje godine). Gnijezda su smještena na visini od 1 do 16 m (prosjek 6.74 m). Gnijezda svraka nađena su na 9 vrsta grmova i drveća. U gnijezdima prvog pologa nalazi se 3–8 jaja (prosjek 5.91 jaja). Prosječna duljina jaja iznosi 33.43 mm, širina 23.35 mm, volumen 9.288 cm^3, indeks oblik jaja 1.433 i težina jaja 9.22 g. Između prosječnih dimenzija jaja u gnijezdima 1997. i 1998. godine nema značajnih razlika (duljina $F = 1.79$, $p = 0.10$; širina $F = 1.41$, $p = 0.34$; volumen $F = 1.27$, $p = 0.52$; indeks oblika $F = 1.10$, $p = 0.78$). Statistički su značajne pozitivne korelacije između volumena i širine jaja, volumena i

dužine jaja, dužine i indeksa oblika jaja duljine i širine jaja i negativna korelacija između širine i indeksa oblika jaja. Između volumena i indeksa oblika jaja koeficijent korelacije (r) je blizu 0.

Ključne riječi: svraka, *Pica pica*, područje gniježđenja, položaj gnijezda, broj jaja u gnijezdu, dimenzije jaja, sjeverozapadna Hrvatska

INTRODUCTION

Numerous articles on the breeding ecology and density of magpie populations have been published during the last 50 years (e.g. RIESE, 1954; HOLYOAK, 1967; BÄHRMANN, 1968; FASOLA & BRICHETTI, 1983; VUORISALO *et al*., 1992; CRAMP & PERRINS, 1994; GORSKA & GORSKI, 1997; VOGRIN, 1998). However, only a few covered the population of S and SE Europe. The features of the study area were favourable for the magpie population. Extensive agriculture with different crops (wheat, maize, barley, rye) grown on small fields and a lot of trees for building nests in resulted in a large number of pairs. Food may put a limit to the population density of a species and may also play a significant role as a dispersing factor in different parts of the year, especially in areas with marked seasonality (NEWTON, 1980). Energetic expenditure is highest during the breeding season for the rearing of young and during winter due to short daylight (MÜLLER, 1983). It is possible that high population densities of magpies in the study area are caused by the scarcity of hooded crows *(Corvus corone cornix*). Magpies and crows are strong interspecific competitors for food (e.g. VINES, 1981; MÜLLER, 1983) and crows are also potential predators (e.g. BAEYENS, 1981; SACHTELEBEN *et al*., 1992). In some areas, the magpie is a social species, foraging in flocks most of the year, only interrupted by the solitary breeding season (VINES, 1981). In others it lives solitarily throughout the year, only frequenting communal roosts outside the breeding period (MÜLLER, 1983).

STUDY AREA, MATERIALS AND METHODS

The study area is situated in the Krapina river valley in north western Croatia (45° 55' – 46° 05' N, 15° 50' – 16° 05' E). The study, which took place in 1997 and 1998, was conducted in a rural area, and nests near or in urban areas were not analysed. All nests were found in bushes and deciduous trees. Two thirds of the research area consisted of agricultural mixed farming areas, and one third of woods. Island-like trees and high bushes within arable land offered good conditions for nesting. The magpie usually starts nest building before the trees leaf, which makes it easier to discover the nests. All nests found were visited at least twice during the breeding period in order to establish the total number of eggs laid. Only first clutches, with the egg-laying period beginning at least on May 15th, were analysed. Thirty nests were analysed in 1997 and 37 in 1998. On the whole 396 eggs were measured to the nearest 0.01 mm with sliding callipers. Egg volume (V) was computed from the maximum length (L) and breadth (B) of each egg, using the formula developed by HOYT (1979):

$$V = 0.51 \times L \times B^2$$

The egg shape index (EI) was calculated according to SCHÖNWETTER (1967–1979):

EI = length (L) / breadth (B)

Using precision Tehnica scales I determined the mass of 180 eggs (0.01 g). This study was based on clutches rather than on single eggs. Data on single eggs are difficult to analyse statistically for several reasons. Eggs within a clutch are not independent, large clutches have a disproportionate effect on the results and outliers may bias the analyses (JÄRVINEN & PRYL, 1989). According to VAURIE (1959) the birds in my study area belong to the subspecies *Pica pica pica.*

RESULTS AND DISCUSSION

a) Population density and nest sites

Magpies are common birds in the study area. Thirty pairs were recorded in the 7 km^2 area in 1997 and 37 pairs in 1998. Population density was 4.79 pairs /km^2 during both years. This is a high density for magpie populations in rural areas. However, magpie population densities are usually higher in urban than in rural areas (e.g. KIRCHHOFF, 1973; DECKERT, 1980; DITTRICH, 1981; SCHIFFERLI & FUCHS, 1981; VINES, 1981; SACHTELEBEN *et al.*, 1992).

Tab. 1 shows data on nest sites in trees or bushes. Out of 67 nests the majority were situated in willow or blackthorn bushes (59.7%). Small woods (up to 50 trees) within stretches of arable land (29.9%) and separate trees were less often occupied (10.4%). Nests were situated at a height of 1–16 m (mean = 6.74 m) above ground. I agree with TATNER (1982) that magpies prefer trees and bushes with denser foliage for nesting. VOGRIN (1998) mentions that the average height of nests above the ground was 5.7 m, TATNER (1982) found a mean of 13.8 m. According to HYLA (1975), nest height was 6–10 m in open areas and 10–15 m near human habitations (towns, cities).

Tab. 1. Nest sites and height of nests above ground of Magpies in northwestern Croatia during 1997–1998. height of nests (m)

nest site	n	%	height of nests (m)	
			range	mean
Common Elm *(Ulmus minor)*	1	1.5	7.0	7.0
Common Oak *(Quercus robur)*	4	6.0	5.0–16.0	10.7
Willow *(Salix* sp.*)*	9	13.4	3.0–6.5	5.5
Willow, bush *(Salix* sp.*)*	26	39.0	1.0–3.5	2.5
Ash *(Fraxinus angustifolia)*	2	3.0	7.0–8.5	7.8
Sticky Alder *(Alnus glutinosa)*	3	4.4	4.5–7.0	5.6
Hornbeam *(Carpinus betulus)*	5	7.4	6.0–14.5	9.8
Common maple *(Acer campestre)*	3	4.4	7.0–14.0	9.1
Blackthorn, bush *(Prunus spinosa)*	14	20.9	1.5–3.0	2.6
Total	67	100.0	1.0–16.0	6.7

b) Clutch size and egg dimensions

We recorded 3–8 eggs in the first clutch (Tab. 2). The majority of pairs laid 6 eggs (44.78%). Only one nest had 3 eggs. The average clutch size was 5.91. VOGRIN (1998) states a clutch size of 6.0. There are no significant differences from other parts of Europe for the subspecies *P. p. pica* (CRAMP & PERRINS, 1994). According to NIETHAMMER (1937) most contained 6–7, rarely 3 or 8 eggs. Occasionally clutches contain 9 or even 10 eggs. According to BÄHRMANN (1968) magpies lay 4–9 eggs in the first clutch and 3–5 eggs in subsequent clutches. DURANGO (1973) gives clutch sizes of 5–11, and PERRINS (1987) 5–7, eggs.

Tab. 2. Clutch size of the Magpie (n = 67) in north-western Croatia during 1997–1998. Only first clutches included.

clutch size	3	4	5	6	7	8
n (nests)	1	7	11	30	14	4

Tab. 3. Eggs dimensions of Magpies in north-western Croatia during 1997–1998. Only first clutches included; clutch sizes used as sampling units.

variable	mean	SD	range	n
length (mm)	33.43	1.112	30.17–35.48	67
breadth (mm)	23.35	0.597	21.59–24.75	67
volume (cm^3)	9.288	0.698	7.772–10.441	67
egg shape index	1.433	0.063	1.284–1.566	67
weight (g)	9.22	0.941	7.67–10.31	30

Egg length in my study area averaged 33.43 mm, egg breadth 23.55 mm, egg volume 9.288 cm^3, egg shape index 1.433 and egg weight 9.22 g (Tab. 3). There are no significant differences between egg dimensions in my studies and the figures given for other European countries. For example, egg length in Belgium is 34.6 mm and egg breadth is 23.7 mm, in the Netherlands 34.6 mm and 24.7 mm, in Britain 34.1 mm and 24.2 mm, and in Germany 33.7 mm and 23.6 mm (VERHEYEN, 1967). The standard egg size variation was the strongest in egg length and the smallest in egg shape index. There are no statistically significant differences for egg dimensions in 1997 and 1998 (Tab. 4). Very slight differences in egg dimensions can be observed if we compare nests according to different clutch sites (Tab. 5). We would also expect bigger clutches to contain smaller eggs, since a larger number of eggs demands a higher energy expenditure. Smaller clutches of other bird species do not contain bigger eggs (e.g. FLINT & SEDINGER, 1992). The egg shape index was the biggest in clutches with 6 eggs. These eggs were more oblong than those in 3–5 or 7–8 egg clutches. We do not have much knowledge on how the egg shape index influences the future of young birds.

Tab. 4. Annual variation in egg dimensions of Magpies in northwestern Croatia during 1997–1998. Only first clutches included.

year	egg length, mm		egg breadth, mm		egg volume cm^3		egg shape index		n
	mean	SD	mean	SD	mean	SD	mean	SD	
1997	33.43	1.385	23.28	0.527	9.241	0.667	1.431	0.066	30
1998	33.42	1.128	23.39	0.631	9.325	0.744	1.426	0.061	37
F	1.79		1.41		1.27		1.10		
p	0.10		0.34		0.52		0.78		

Correlation of egg size variables of 67 clutches showed the most significant positive correlation between egg volume and egg breadth (Pearson's correlation, $r = 0.81$; $p < 0.001$; $n = 67$; Fig. 1 A). A significant correlation was also found between egg volume and egg length ($r = 0.76$; $p < 0.001$; $n = 67$) as well as between egg length and egg shape index ($r = 0.62$; $p < 0.001$; $n = 67$). A slighter correlation was

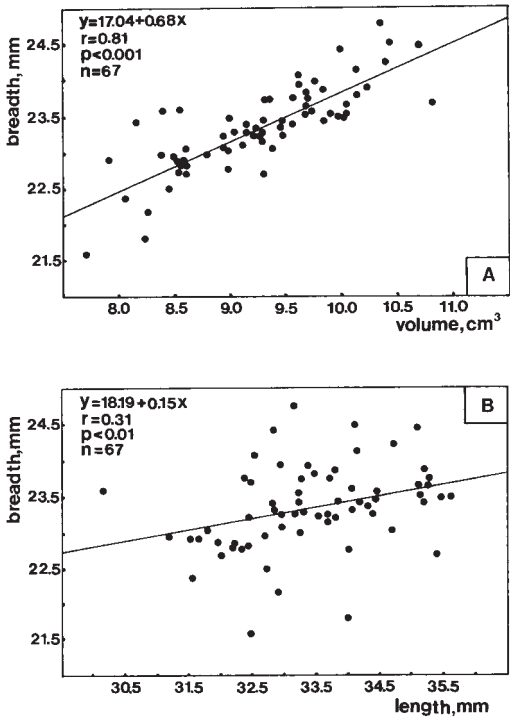

Fig. 1. The relationship between egg volume and egg breadth (A) and egg length and egg breadth (B) in the first clutches of the Magpie in north-western Croatia during 1997–1998.

Tab. 5. Egg dimensions of Magpies in north-western Croatia according to different clutch sizes during 1997–1998. Only first clutches included.

clutch size	egg length, mm		egg breadt, mm		egg volume, cm^3		egg shape index		n
	mean	SD	mean	SD	mean	SD	mean	SD	
3–5	33.19	1.022	23.32	0.644	9.187	0.734	1.421	0.069	19
6	33.44	1.371	23.29	0.532	9.251	0.662	1.445	0.068	30
7–8	33.66	0.944	23.46	0.632	9.448	0.683	1.431	0.057	18

found between egg length and egg breadth ($r = 0.31$; $p < 0.01$; $n = 67$, Fig. 1 B). The negative correlation between egg breadth and egg shape index is also statistically significant ($r = -0.39$; $p < 0.001$; $n = 67$). The correlation between egg volume and egg shape index was not statistically significant ($r = 0.08$; p = n.s; $n = 67$).

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SAŽETAK

Gustoća tijekom gniježđenja, smještaj gnijezda, veličina pologa i dimenzije jaja vrste svraka *(Pica pica)* na području sjeverozapadne Hrvatske

Z. Dolenec

U ornitološkim istraživanjima posljednjih su desetljeća respektabilno zastupljeni nidobiološki sadržaji. U ovome radu dani su rezultati dvogodišnjeg istraživanja gniježđenja vrste svraka (*Pica pica*) na dijelu sjeverozapadne Hrvatske. Istraživanja su obavljana na površini veličine 7 km^2 na području porječja rijeke Krapine. Drveće i grmlje u obliku otoka unutar poljoprivrednih površina nudi povoljne uvjete za gniježđenje. Izravni kompetitor za hranu i mogući predator siva vrana *(Corvus corone cornix*) nije brojna, pa je to vjerojatno jedan od čimbenika visoke gustoće svrake na istraživanom ruralnom području. Kod smještaja gnijezda prednost ima grmlje s gušćom krošnjom. Veličina pologa i dimenzije jaja slični su podacima koje nam daju drugi europski ornitolozi. Budući da je na području sjeverozapadne Hrvatske sve prisutniji antropogeni čimbenik u preobrazbi krajolika (melioracije, ces-

tovni promet, kemijska zaštitna sredstva u poljoprivrednoj proizvodnji i slično), nužna su daljnja istraživanja u smislu utvrđivanja mogućih negativnih posljedica na obitavajuću populaciju vrste svraka kao i biološke raznolikosti uopće.